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Compression with the Juxta Reduction Kit® (medi) in patients undergoing a total knee arthroplasty

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Introduction

Total knee replacement (TKA) is a successful operation in the treatment of osteoarthritis. Enhanced recovery programs, with emphasis on early mobilization and optimal analgesics have reduced hospital stay and peri-operative morbidity.^{1,2}

Patients undergoing a knee arthroplasty can experience pain, swelling, a decrease in knee-extension strength, loss of range of motion (ROM), causing a decline in functional performance.³⁻⁶ Problems with the activation of the quadriceps, in the early postoperative phase can be related to either the surgical procedure or arthrogenic reflex inhibition of the muscle related to pain and swelling.⁷

Post-operative swelling is mainly caused by intra-articular bleeding and inflammation of peri articular tissues.⁸

Impaired functional performance can delay rehabilitation and affect length of stay and patient-reported outcomes.⁸

Thereby, excessive swelling is associated with increased rates of wound dehiscence and infection in surgical wounds.⁹

Compression therapy is a frequently used modality in the postoperative treatment to reduce swelling. The literature is not consistent about the effects of compression therapy. This is due to the use of various materials, the time frame of application and the different outcome measurements used.^{8,10,11} Our experiences with compression in the treatment of venous ulcers and lymphedema create possibilities to introduce compression technologies in other fields of medicine, such as orthopaedic sur-

gery.

Regarding the type of bandage, inelastic compression bandages show a low, tolerable resting pressure and a more effective activation of the deep venous system and calf muscle pump with ambulation (working pressure) compared to elastic materials.^{12,13}

The Juxta Reduction Kit® (JRK) is a non-elastic compression device, suitable for self-management, which can be tailored to the circumference of the leg. The device allows full ROM, so ambulation and exercise will not be impaired.

It is hypothesized that immediate post-operative compression and prolonging the period of use until 6 weeks postoperatively will prevent excessive swelling and initiate an earlier reduction. Reduced swelling improves range of motion, knee extension strength, reduces pain, supporting the rehabilitation process.

The research questions concern feasibility and effectiveness of the treatment on volume, pain, wound aspects and functional recovery. In this article we will focus on study design and feasibility aspects.

Materials and Methods

In Nij Smellinghe hospital the *fast-track principles* have been implemented in joint replacement surgery.

Ambulation and exercise of the patient start 4 hours postoperative and patients are discharged when they are functional independent.

Table 1 shows the compression and exercise protocols for the control and treatment group.

Patients are instructed about the use of the JRK prior to the operation and during clinical stay. They are instructed to apply a firm, but tolerable dose of compression.

After having signed the inform consent patients are randomly assigned to either the control or the treatment group.

Inclusion criteria: i) 18 years of age or older; ii) patients undergoing a primary elective total knee arthroplasty; iii) the patient is able to understand the study and is willing to give written Informed Consent.

Exclusion criteria: i) allergy against one of the used materials; ii) severe systemic diseases causing peripheral edema; iii) acute superficial or deep vein thrombosis; iv) arterial occlusive disease (stadium II, III or IV) ABPI<0.8; v) local infection in the therapy area; vi) auto-immunological disorders or vasculitis; vii) use of systemic corticosteroids; viii) inability to don, doff and

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adjust the device.

The local Medical Ethical Committee approved the study. The study was registered under ClinicalTrials.gov, NCT02375945.

Measurements and data collection

Feasibility data are collected about the number of patients recruited and dropped out, time required for the whole process (measurements, preparation of the JRK, instruction of the patient and administration), pain in action (PA) and in rest (PR), the ability to exercise and sort and number of complications.

Data collection was pre-operative, day 1 and day 2 during hospital stay and at day 14, 42 and 84 after discharge.

Statistical analyses

All data are analyzed with the programming language R version 3.3.0 for statistical computing. A P-value smaller than or equal to 0.05 is considered to be statistically significant.

Results

In total 68 patients were included (32 patients in the control group and 36 patients in the treatment group). 19 patients in the control group (13 drop outs) and 20 patients in the treatment group (16 drop outs) completed the study.

Measurements, preparation of the JRK, instruction and administration demanded 6 hours per patient.

Pain scores in rest and action are shown in Figure 1. Figures 2 and 3 show the *inter-action data plots*.

The ability to exercise was successful in the first phase of recovery. When the ROM comes closer to the 90 degrees of flexion the material strips up at the back of the knee and restricts the possibility to flex the knee. No complications did occur.

Conclusions

The VAS scores for pain in rest and in action showed no significant differences between the two groups. Regarding feasibility

this is considered positive, because more pain was expected by adding compression in the first phase of recovery. A limitation of this study is that no data were collected about the use of pain-medication. The analgesic influence of compression on the pain

cannot be stated.

This pilot study demonstrates a feasible concept. Regarding outcome on volume the preliminary results show a positive effect in favor of the treatment group, supporting the need for further research.

Table 1. Compression and exercise protocol.

Control group			Treatment group		
<ul style="list-style-type: none"> Immediately postoperative until 24 hours postoperative compression with elastic bandages for the knee region with Elastomuhl Haft® (Jobst) From 24h until 6 weeks postoperative an anti-thrombosis stocking, Comprinet stocking® (BSN Medical) Ambulation and exercise program according to the <i>fast-track principles</i> 			<ul style="list-style-type: none"> Immediately postoperative until 6 weeks postoperative, 24/7 compression with the JRK®+ Struva®, class 2 anti-thrombosis stocking (medi) Ambulation and exercise program according to the <i>fast-track principles</i> 		
Results Control group		Results Treatment group		P-value. Time effects	P value. Group by time interaction effects
Mean	SD	Mean	SD		
Pain Rest (VAS 0-10)		Pain Rest (VAS 0-10)			
T0	2.8	2.7	3.9	2.9	
T1	4.3	2.6	5.9	1.9	0.039
T2	2.0	2	3.8	1.7	0.296
T14	2.6	2.1	3.8	2.4	0.637
T42	2.1	2.3	1.9	1.7	0.198
T84	0.7	1.1	0.8	1.7	0.001
Pain Action (VAS 0-10)		Pain Action (VAS 0-10)			
T0	5.8	2.8	5.9	2.4	
T1	5.8	3.1	6.6	1.9	0.888
T2	4.3	3.2	4.9	1.7	0.098
T14	3.4	2.9	3.8	2.3	0.002
T42	2.7	2.5	2.7	2.3	<0,001
T84	1.5	1.7	1.7	2.3	<0,001

Figure 1. Pain scores in rest and action.

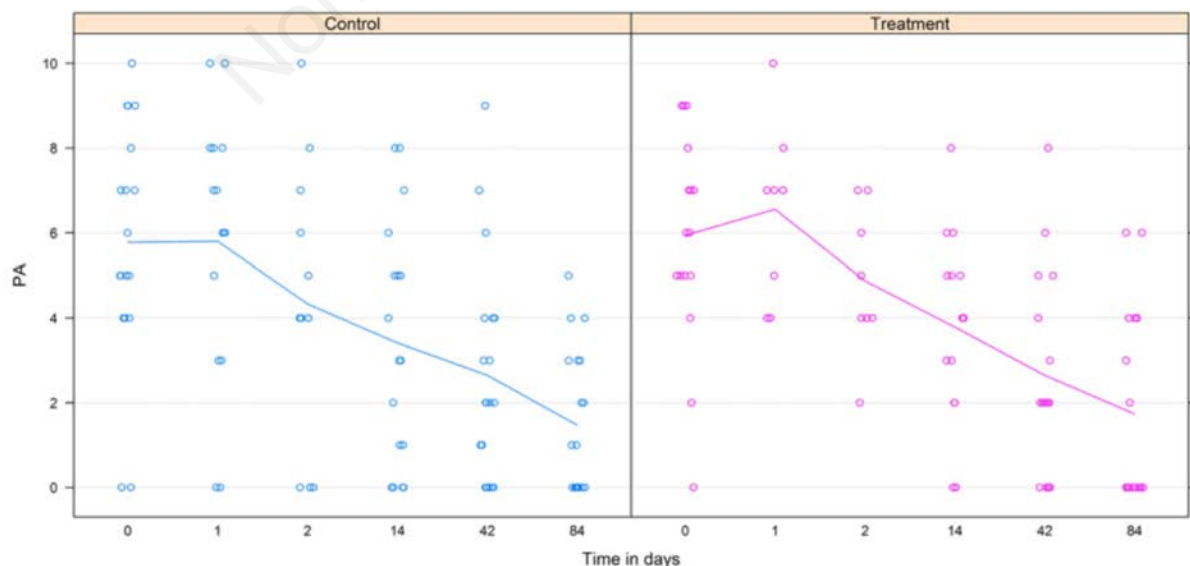


Figure 2. Interaction plot pain in action (PA).

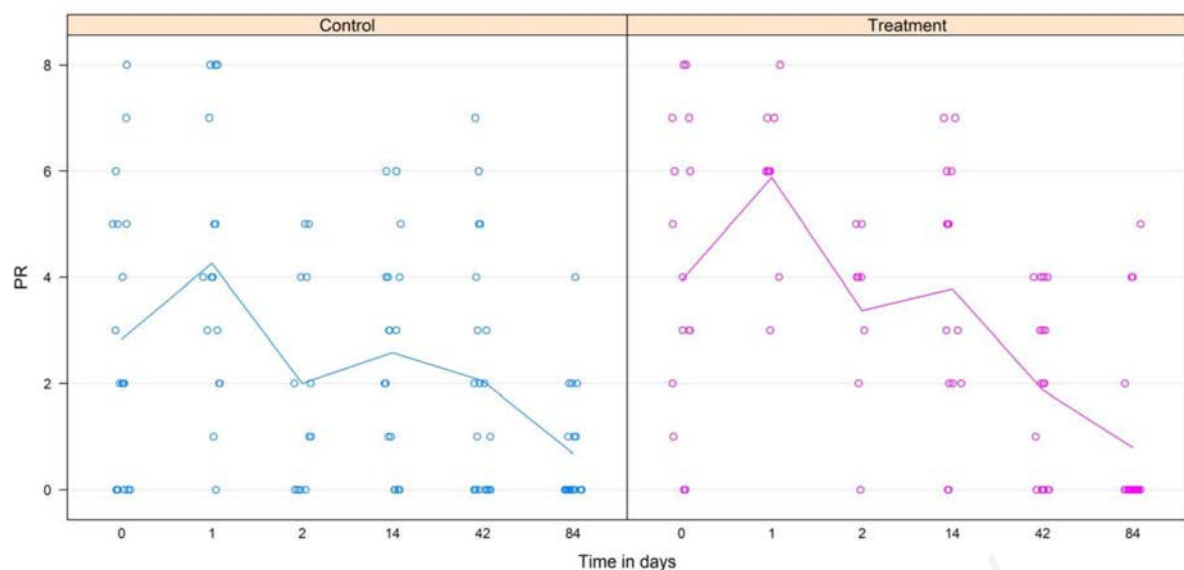


Figure 3. Interaction plot pain in rest (PR).

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